

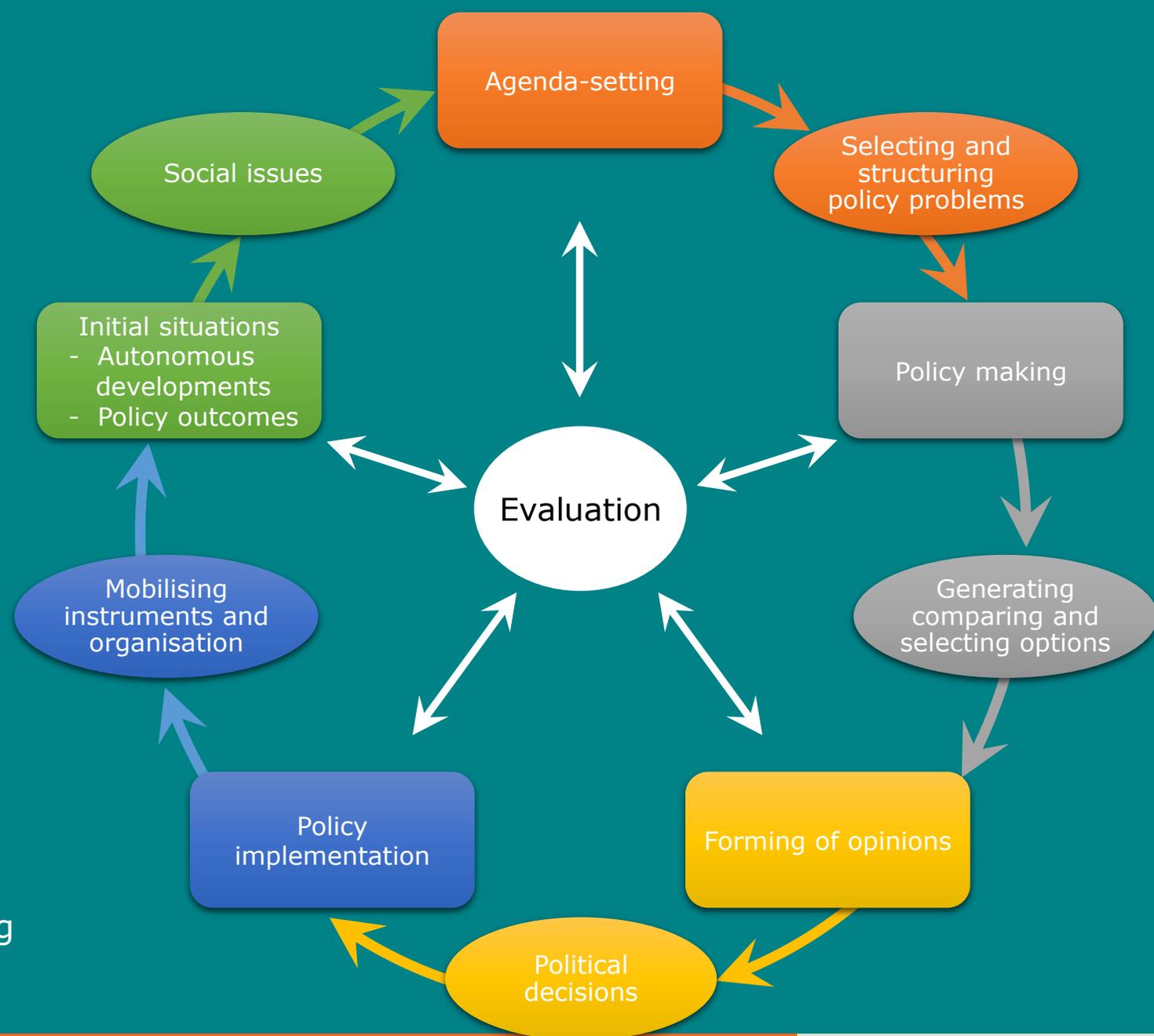
March 2016, Bandung

Policy making

Pre-workshop ITB

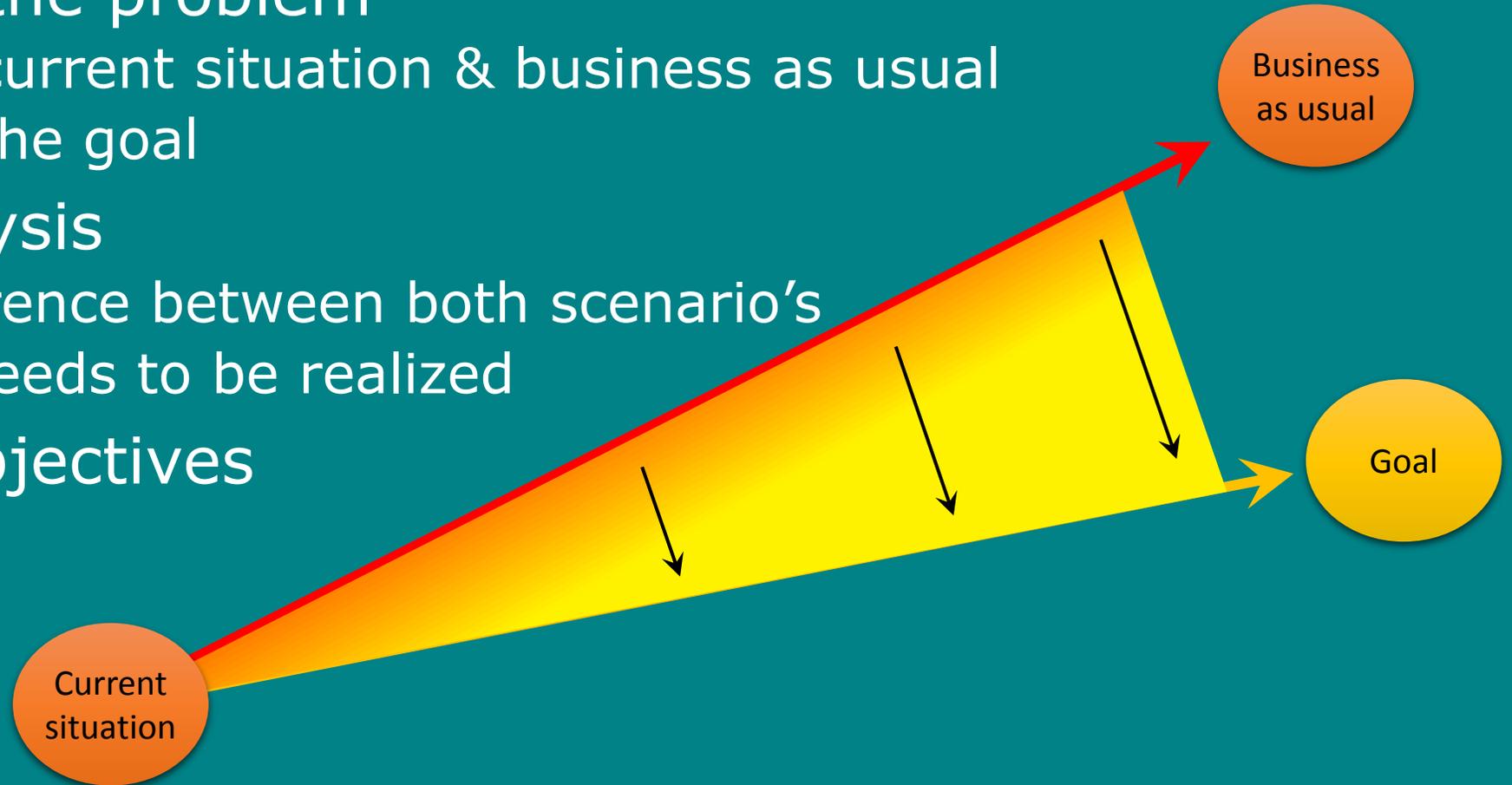
Policy cycle

1. Framing the problem
Select & structure problems
2. Create objectives
Compare and select options
Use input stakeholders
3. Stakeholder involvement
Mobilize instruments & involve organisations
4. Decide on political/
regulatory instruments
Implementation of political/
regulatory instruments
5. Evaluate outcome
Compare with initial problem setting



Agenda setting

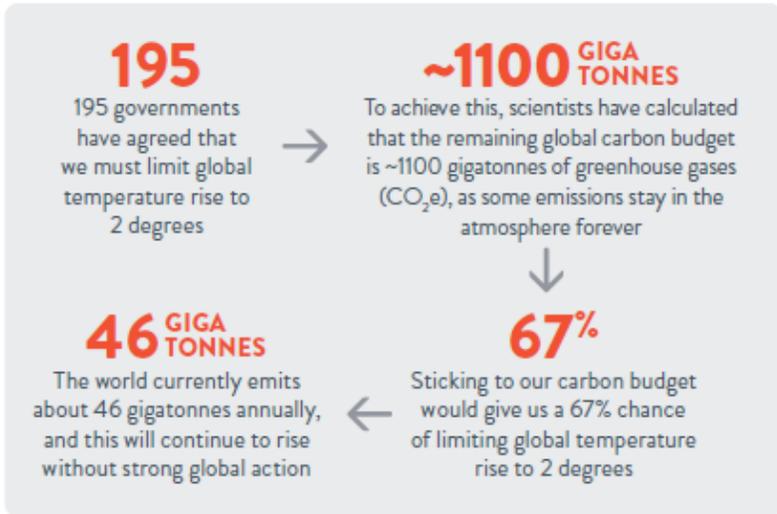
- Framing the problem
 - Define current situation & business as usual
 - Define the goal
- Gap analysis
 - The difference between both scenario's is what needs to be realized
- Create objectives



THE CARBON BUDGET

The carbon budget is the finite amount of greenhouse gases we can emit to limit global temperature rise to 2°C

2°C THE GLOBAL CARBON BUDGET



3°C WHAT IF WE BLOW THE BUDGET?

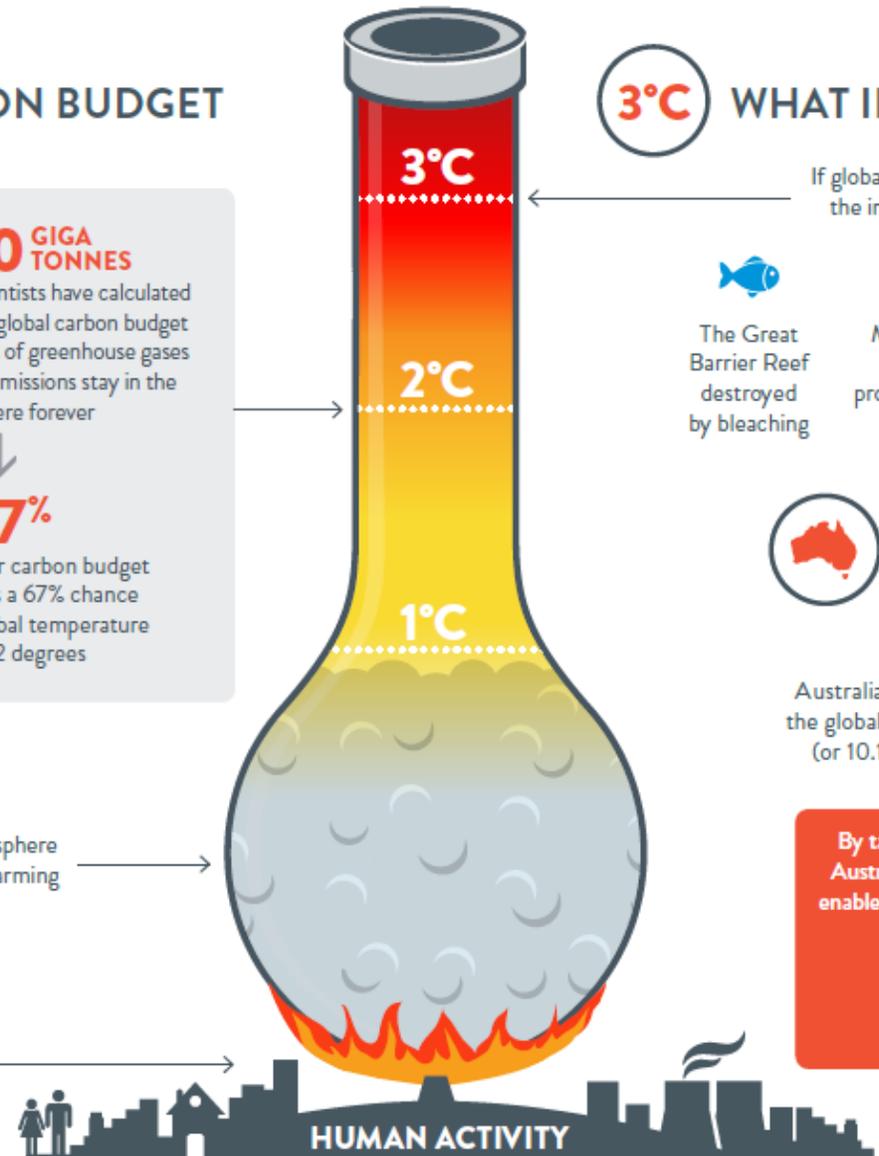


AUSTRALIA'S BUDGET



1°C Emissions accumulating in the atmosphere have already caused almost 1°C of warming

Human activity such as fossil fuel use produces greenhouse gas emissions, which causes the planet to warm



By taking strong action with the rest of the world, Australia can stretch its carbon budget to 2050, to enable a smooth transition to a zero net carbon future

WE HAVE A PLAN

- [CLIMATEWORKS.COM.AU](https://climateworks.com.au)
- [2050PATHWAYS.NET.AU](https://2050pathways.net.au)

Criteria & indicators to conduct evaluations

- Effectiveness
- Efficiency
- Equity
- Institutional feasibility
- Replicability

Complexity of regulation

- Different institutes design and manage geothermal regulations. Not all institutes have the expertise on geothermal energy
- Underground resource: ownership & access
- clear procedures need to exist before (often private)
- companies are willing to invest the large amounts of capital in the subsequent phases of
- geothermal development

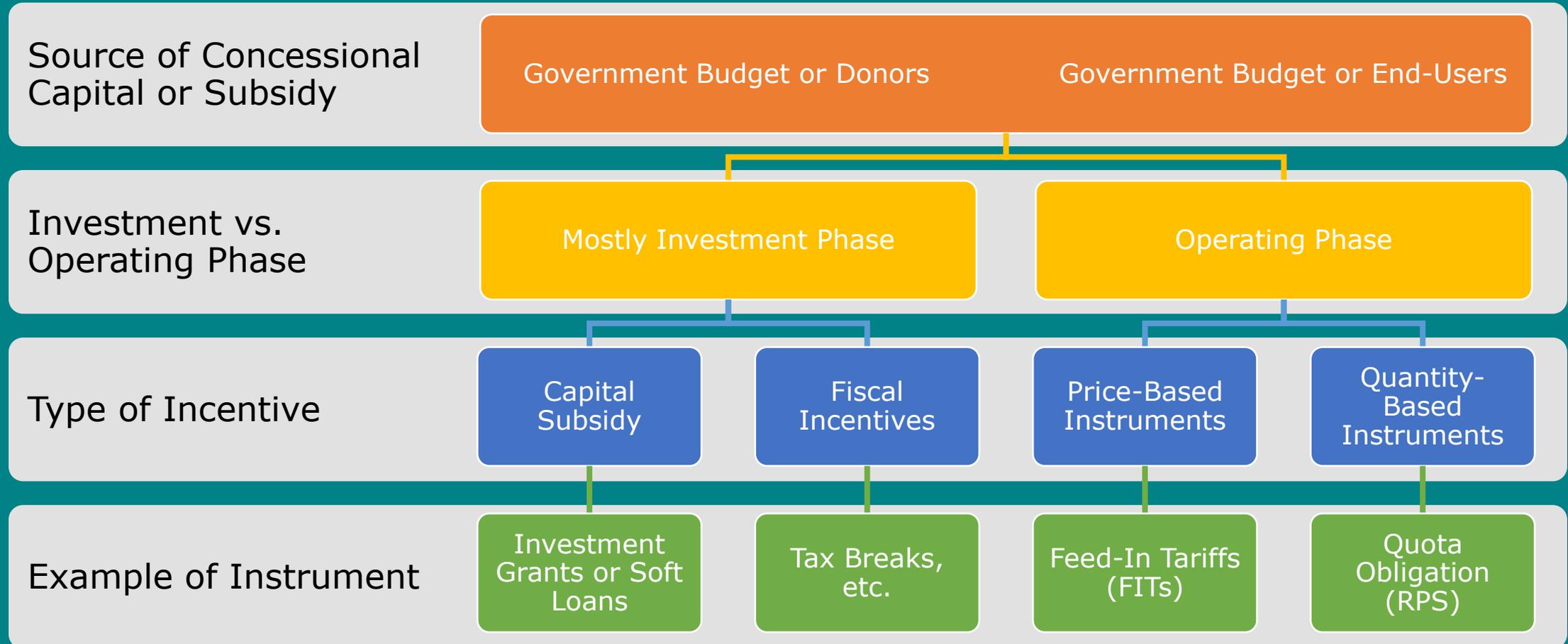
Policies & regulation

- Challenge: balance the development of publicly owned geothermal resources with environmental and community requirements
- How: set of regulations, institutions, monitoring and investment policies with or without the aid of international donors.

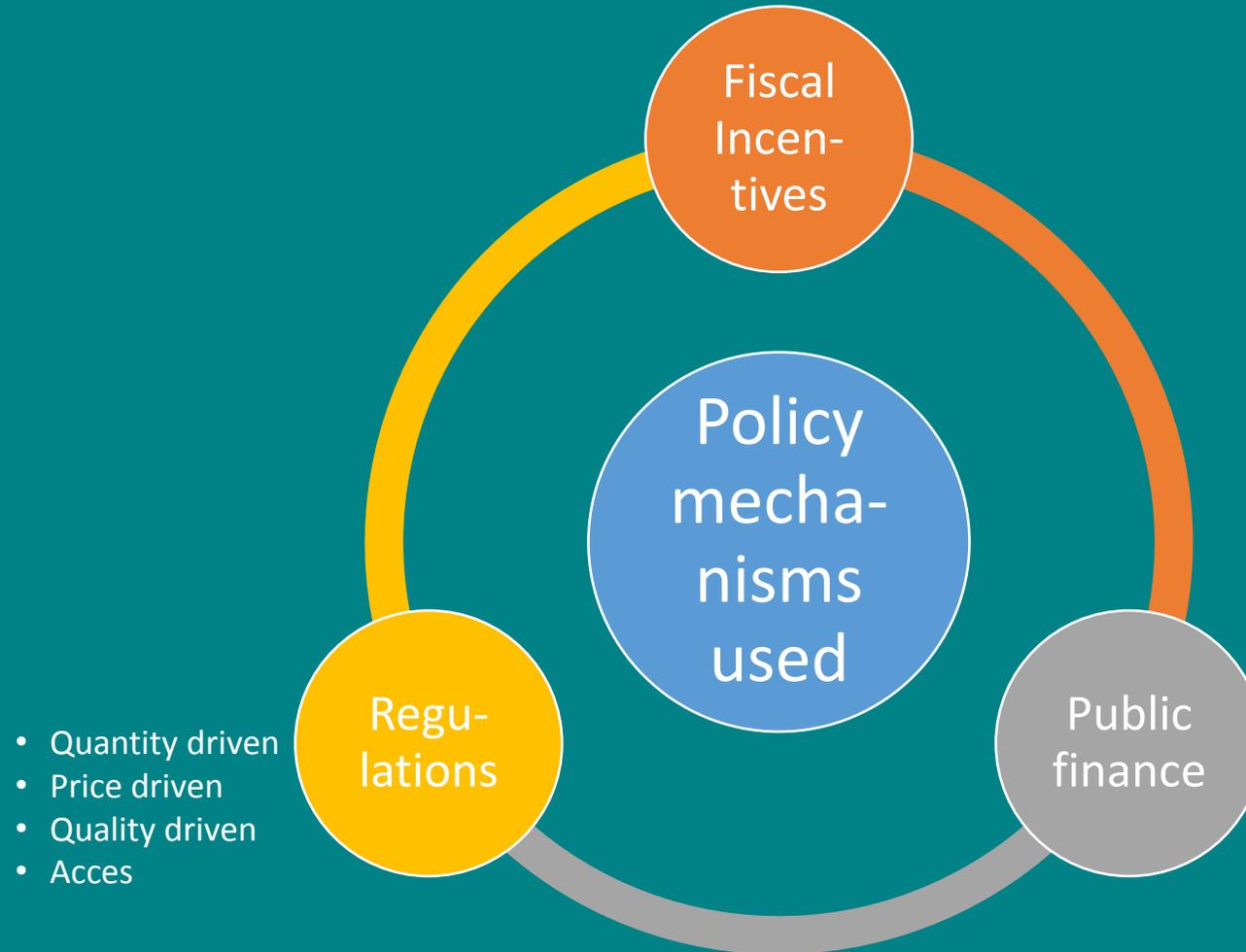
Policy making

- transferred responsibility for award of concessions (Geothermal Working Areas) back to central government, under the Minister of Energy
- Development of indirect use project needs to reflect Government policy in terms of prioritisation
- addressing the regulations required to implement the new law, we need to start by understanding the geothermal development process, the various stages involved, what those stages are trying to achieve and how they interact with each other
- development process should be one of limiting risk by limiting financial exposure until the risk of failure is reduced

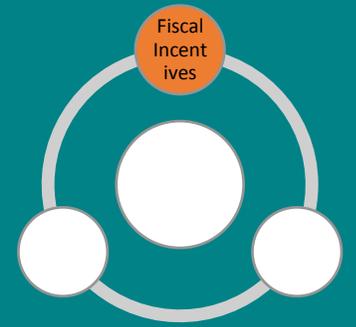
Policy and Regulatory Instruments Supporting Deployment of Renewable Electricity



Policy mechanisms used



Source: Irena, policy brief, evaluating policies in support of the deployment of renewable power; 2012. www.irena.org/publications



Fiscal Incentives

Grant

Monetary assistance
 No repayment requirements
 Usually conditional upon certain qualifications.
 Grants (and rebates) help reduce CAPEX costs.
 Grants may be used to create concessional financing instruments (e.g., allowing banks to offer low-interest loans for RE systems).

Energy production payment

Direct payment
 By government
 Per unit of RE produced.

Rebate

One-time direct payment
 From the government to a private party
 Cover a % or specified amount of the CAPEX.
 Typically offered automatically to eligible projects, after completion
 Not requiring detailed application procedures.

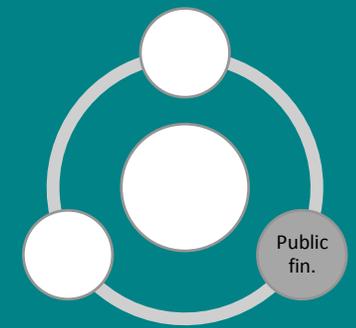
Tax credit (production or investment)

Provides the investor or owner with an annual income tax credit
 Based on the amount of money invested in that facility
 Or based on the amount of energy that it generates during the relevant year.
 Allows investments in RE to be fully or partially deducted from tax, obligations or income.

Tax reduction / exemption

Reduction in tax including but not limited to sales, value-added, energy or carbon tax
 applicable to the purchase (or production) of RE or RE technologies.

Public finance



Investment

Financing provided in return for an equity ownership interest in a RE company or project.

Usually delivered as a government-managed fund

Direct investment in equity and companies,

Or as funder of privately managed funds (fund of funds).

Guarantee

Risk-sharing mechanism

Aimed at mobilizing domestic lending from commercial banks that have high perceived credit (i.e., repayment) risk.

Typically a guarantee is partial, it covers a portion of the outstanding loan principal (50 - 80% common).

Loan

Financing provided in return for a debt (i.e., repayment) obligation.

Provided by

- government,
- development bank
- investment authority

usually on concessional terms

- e.g., lower interest rates or
- with lower security requirements.

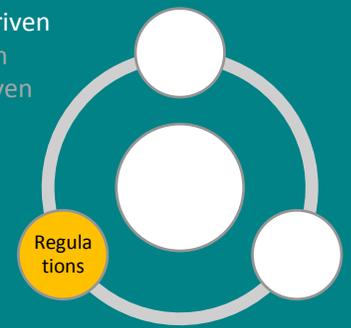
Public procurement

Public entities preferentially purchase RE services

(such as electricity)

and/or RE equipment

- Quantity driven
- Price driven
- Quality driven
- Access



Regulations – *Quantity-driven*

Renewable Portfolio Standard / Quota obligation or mandate

Obligates designated parties (generators, suppliers, consumers) meet minimum (often gradually increasing) RE targets,

- generally expressed as percentages of total supplies or
- as an amount of RE capacity, with costs borne by consumers.

Building codes or obligations requiring installation of RE heat or power technologies

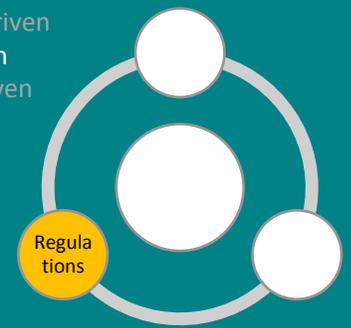
Often combined with efficiency investments (RE heating purchase mandates).

Mandates for blending biofuels into total transportation fuel in % or specific quantity.

Tendering / Bidding

Public authorities organise tenders for given quota of RE supplies or supply capacities, remunerate winning bids at prices mostly above standard market levels

- Quantity driven
- Price driven
- Quality driven
- Acces



Regulations – *Price-driven*

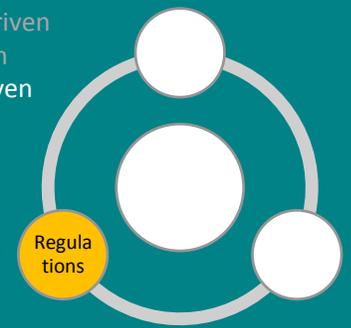
Fixed payment
feed-in tariff (FIT) Guarantees RE supplies with priority access and dispatch

Setting a fixed price varying by technology per unit

Delivered during a specified number of years.

Premium payment
FIT Guarantees RE supplies an additional payment on top of their energy market price or end-use value.

- Quantity driven
- Price driven
- Quality driven
- Acces



Regulations – *Quality driven*

Green energy purchasing

Regulates the supply of voluntary RE purchases by consumers beyond existing RE obligations.

Green labelling

Government-sponsored labelling

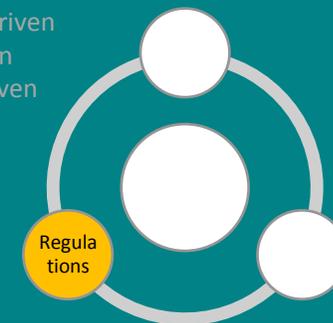
- there are also some private sector labels

Guaranteeing that energy products meet certain sustainability criteria to facilitate voluntary green energy purchasing.

Some governments require labelling on consumer bills, with full disclosure of the energy mix (or share of RE).

Regulations – Access

- Quantity driven
- Price driven
- Quality driven
- Access



Net metering (also net billing)

Allows a two-way flow of electricity between the electricity distribution grid and customers with their own generation.

The meter flows backwards when power is fed into the grid

Power compensated at the retail rate during the 'netting' cycle

regardless of whether instantaneous customer generation exceeds customer demand.

Priority or guaranteed access to network

Provides RE supplies with unhindered access to established energy networks.

Priority dispatch

Mandates that RE supplies are integrated into energy systems before supplies from other sources.

Feed in tariffs in the World



Figure 3. Countries with feed-in tariffs in 1990.

1990



Figure 4. Countries with feed-in tariffs in 2000.

2000



Figure 5. Countries with feed-in tariffs in 2010k, also for island-networks.

2010

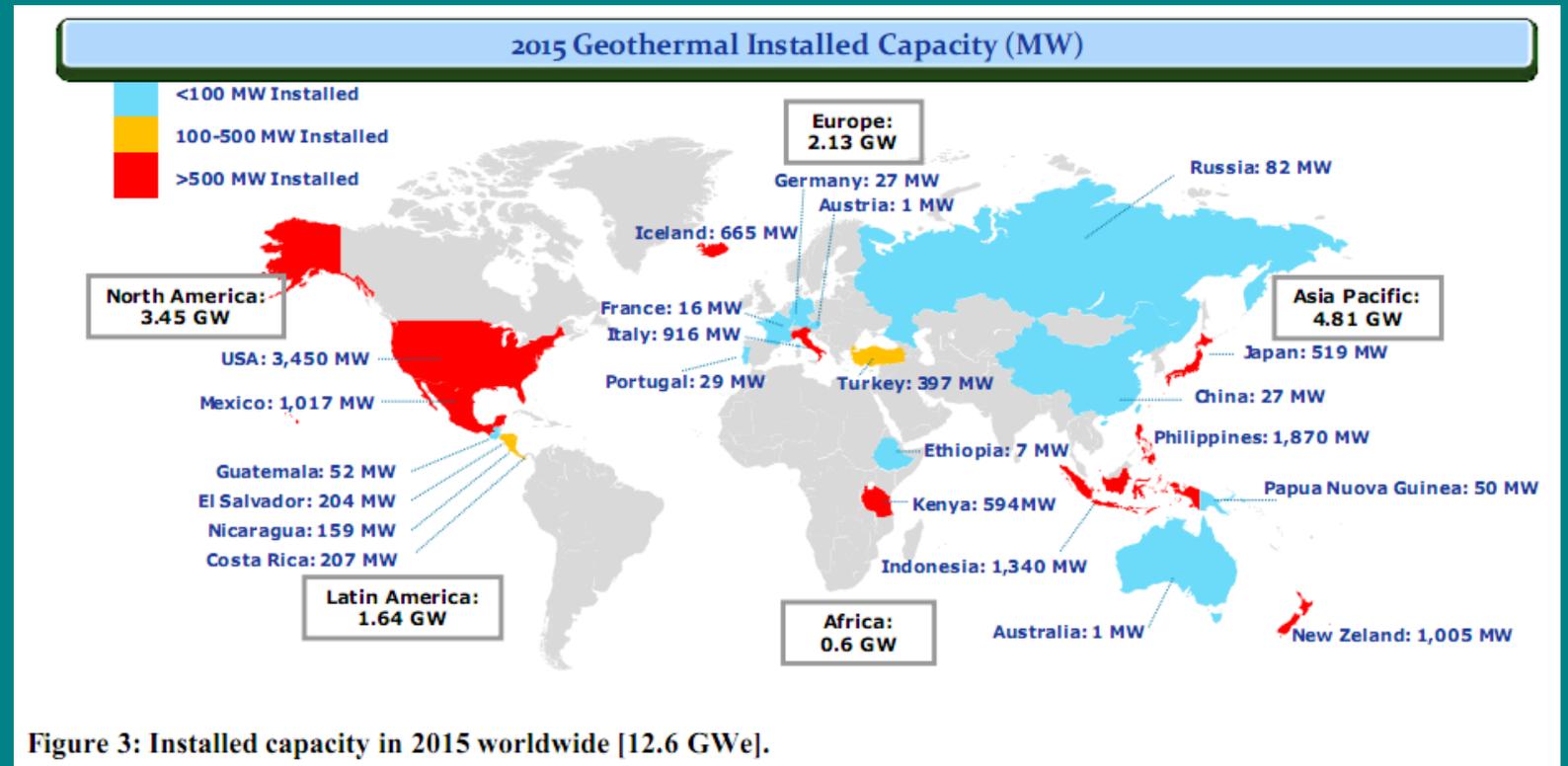
Installed capacity

ICELAND

US

NEW ZEALAND

AFRICA



<http://euanmearns.com/geothermal-energy-in-perspective/>

ICELAND

"Iceland's Climate Change Strategy",

- February 2007
- Conceived as a framework for action and government involvement in climate change issues,
- Sets forth a **long-term aspirational goal of reducing net greenhouse gas emissions by 50-75% of 1990 levels by the year 2050.**

Principal objectives

- Reduce greenhouse gas emissions, with a special emphasis on reducing the use of fossil fuels in favour of renewable energy sources and climate-friendly fuels;
- and - fostering research and innovation in fields related to climate change affairs and promoting the exportation of Icelandic expertise in fields related to renewable energy and climate-friendly technology.

Actions:

- prioritise research on the feasibility of pumping carbon dioxide from geothermal power plants back into the earth;
- place increased emphasis on the exportation of technology and know-how in fields related to the utilisation of renewable energy resources;
- examine whether Iceland or Icelandic companies could engage in projects under the Clean Development Mechanism concerning geothermal energy or other climate-friendly technologies.



<https://en.wikipedia.org/wiki/Krati>

NO FIT FOR GEOTHERMAL ENERGY

US

State Renewable Portfolio Standards (RPSs) (in force)

- flexible-market based policies, requiring that electricity providers obtain a minimum percentage of their power from RES by a certain date.
- Each state chooses to fulfill its mandate using a combination of renewable energy sources, including wind, solar, biomass, geothermal, or other renewable sources.
- Some RPSs will specify the technology mix, while others leave it up to the market.
- Currently there are 33 states plus the District of Columbia that have RPS requirements or goals in place.

US Climate Action Plan (in force)

- Three pillars:
 - cut carbon pollution in the United States;
 - prepare the United States for the impacts of climate change;
 - lead international efforts to combat global climate change and prepare for its impacts.

Clean Power Plan (under review)

- sets goals for **reducing the US's GHG emissions 32% by 2030** (which exceeds the US's COP21 NDC target of 26-28%).
- The EPA established interim and final statewide goals in three forms:
 - A rate-based state goal measured in pounds per megawatt hour (lb/MWh);
 - A mass-based state goal measured in total short tons of CO₂;
 - A mass-based state goal with a new source complement measured in total short tons of CO₂.

Table 39. FIT in USA.

Type of generating capacity	Years	Tariff, USD / kWh	Tariff, EURO / kWh
Solar			
California	3	0.48	0.370
Florida			
up to 10 kW	20	0.30	0.237
from 10 kW to 25 kW	20	0.28	0.215
over 25 kW	20	0.23	0.178
Hawaii	20	0.26	0.203
Michigan	12	0.43	0.333
New Mexico	12	0.20	0.156
Rhode Island			
from 10 kW to 150 kW	15	0.32	0.247
from 150 kW to 500 kW	15	0.30	0.234
from 500 kW to 5 MW	15	0.28	0.215
Texas	20	0.26	0.200
Tennessee	10	0.19	0.146
Vermont	25	0.30	0.222
Washington	8	0.61	0.452
Wisconsin	10	0.25	0.185
Wind			
Hawaii	20	0.14	0.102
Minnesota			
	1-10	0.04	0.035
	11-20	0.03	0.024
Rhode Island	15	0.13	0.099
Vermont			
up to 50 kW	20	0.20	
from 50 kW to 2.2 MW	20	0.13	
Washington	8	0.41	0.304
Hydro			
Hawaii	20		0.140
Vermont	20		0.093
Biomass			
Vermont		0.13	0.093
Biogas			
Washington		0.15	0.111

NO FIT FOR GEOTHERMAL ENERGY

US

TITLE	COUNTRY	YEAR	POLICY STATUS	POLICY TYPE	POLICY TARGET
Onshore Renewable Energy Development Programs	United States	2009	In Force	Economic Instruments>Fiscal/financial incentives>Grants and subsidies, Policy Support>Strategic planning, Information and Education>Information provision	Multiple RE Sources>Power, Wind, Solar, Solar Thermal, Bioenergy, Geothermal
Residential Renewable Energy Tax Credit	United States	2006 (amended 2008, 2009)	In Force	Economic Instruments>Fiscal/financial incentives>Tax relief	Wind, Geothermal, Solar>Solar photovoltaic, Solar Thermal
Federal Business Investment Tax Credit (ITC)	United States	1992; updated 2005, 2006, 2008, 2009	In Force	Economic Instruments>Fiscal/financial incentives>Tax relief	Solar Thermal, Geothermal, Solar>Solar photovoltaic
Modified Accelerated Cost Recovery System (MACRS)	United States	1986; updated 2008	In Force	Economic Instruments>Fiscal/financial incentives>Tax relief	Wind>Onshore, Geothermal, Solar Thermal, Wind, Wind>Offshore

NEW ZEALAND

Open competition
between private (part)
state-owned
generation companies.

Very limited support
from NZ Emissions
Trading Scheme.

Geothermal
competitive 'on its
own'.

- http://www.irena.org/DocumentDownloads/events/2014/June/TechnicalTraining/3_vanCampen.pdf

AFRICA, examples

Table 26. FiT in Kenya.

Type of generating capacity	Years	Tariff, KES / kWh	Tariff, EURO / kWh
Solar			
from 500 kW to 10 MW (firm)	20	17.80	0.148
from 500 kW to 10 MW (non firm)	20	8.90	0.074
Wind			
from 500 kW to 100 MW	20	10.70	0.089
Hydro			
firm			
from 500 kW to 1 MW	20	10.70	0.089
from 1 MW to 5 MW	20	8.90	0.074
from 5 MW to 10 MW	20	7.09	0.059
non firm			
up to 1 MW	20	8.90	0.074
from 1 MW to 5 MW	20	7.09	0.059
from 5 MW to 10 MW	20	5.29	0.044
Biomass			
from 500 kW to 100 MW (firm)	20	7.09	0.059
from 500 kW to 100 MW (non firm)	20	5.29	0.044
Biogas			
from 500 kW to 40 MW (firm)	20	7.09	0.059
from 500 kW to 40 MW (non firm)	20	5.29	0.044
Geothermal			
up to 70 MW	20	10.70	0.089

African Countries Using Or Having Carried Out Research On Geothermal Resources



Kenya and Uganda both have tariffs for geothermal energy,

- Kenya's program doesn't offer a true feed-in tariff. The tariff in Kenya is a price ceiling rather than a minimum price. The final payment per kilowatt-hour in Kenya is negotiated.

Uganda,

- on the other hand, places a cap on annual geothermal development to control program costs.
- Geothermal development in Uganda is limited to 75 MW by 2014.

Indonesia

Table 1: FiTs for renewable energy sources in Indonesia

Energy source	Feed-in tariff	Conditions	Relevant legislation
Geothermal	US\$ 0.01 - 0.19/kWh	Depends on location, and whether the power plant is connected to a high- or medium voltage network	MEMR Regulation No. 22 of 2012
Mini and Micro hydro	Rp 656 - 1,506/kWh	<10 MW, dependent on location and whether connected to low or medium voltage network	MEMR Regulation No. 4 of 2012
Biomass	Rp 975 - 1,722.5/kWh		
Municipal solid waste (non-biogas)	Rp 1,050 - 1,398/kWh		
Municipal solid waste (landfill gas)	Rp 850 - 1,198/kWh		
Solar PV	Price ceiling US\$ 0.25 - 0.30/kWh	Purchase agreements through tenders. Price ceiling dependent on use of 40% local materials	MEMR Regulation No. 17 of 2013

Geothermal Feed-in Tariffs Worldwide

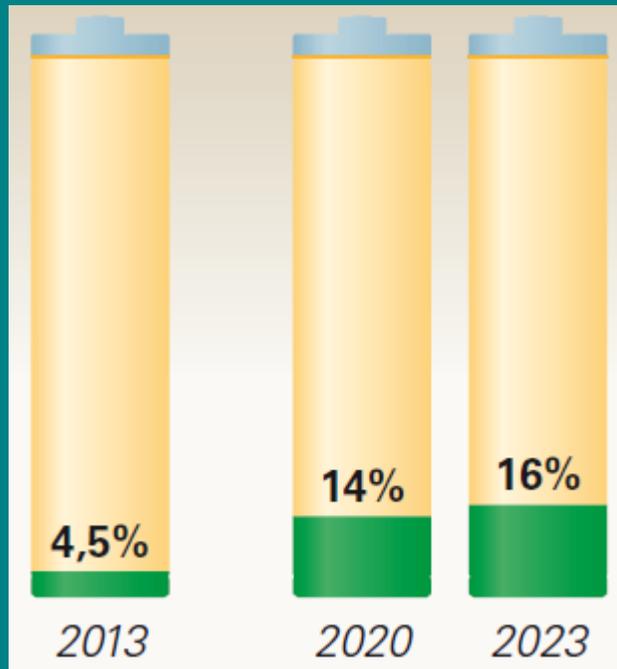
Geothermal Tariffs Worldwide Summary				
Jurisdiction	Years	Tariff €/kWh	1.3946 CAD/kWh	1.4390 USD/kWh
Germany	20			
<10 MW		0.157	0.219	0.226
>10 MW		0.103	0.144	0.148
Bonus for installation before 2016		0.039	0.055	0.056
District heating bonus		0.029	0.041	0.042
Technology bonus for hot-dry-rock		0.039	0.055	0.056
France				
Continental <12 MW	15	0.200	0.279	0.288
Plus premium for heat content <30%		0	0	0
		Linear interpolation		
>70% efficiency		0.080	0.112	0.115
Overseas Territories <12 MW	15	0.130	0.181	0.187
Plus premium for heat content <30%		0	0	0
		Linear interpolation		
>70% efficiency		0.03	0.042	0.043
Greece	20			
Mainland		0.081	0.114	0.117
Islands		0.097	0.135	0.140
Italy <1 MW	15	0.200	0.279	0.288
Spain <50 MW	20	0.071	0.099	0.102

Geothermal Tariffs Worldwide Summary				
Jurisdiction	Years	Tariff €/kWh	1.3946 CAD/kWh	1.4390 USD/kWh
	+20	0.067	0.094	0.097
Slovakia	12	0.196	0.273	0.282
Slovenia	15			
<50 kW		0.152	0.213	0.219
>50 kW<1,000 kW		0.152	0.213	0.219
>1 MW<10 MW		0.152	0.213	0.219
>10 MW<125 MW			n/a	
Switzerland	20			
<5 MW		0.309	0.432	0.445
<10 MW		0.279	0.388	0.401
<20 MW		0.217	0.302	0.312
>20 MW		0.176	0.245	0.253
Croatia	12			
<1 MW		0.174	0.242	0.250
>1 MW		0.174	0.242	0.250
Czech Republic	15	0.158	0.220	0.227
Kenya <70 MW*	20	0.059	0.082	0.085
Serbia	12	0.075	0.105	0.108
Taiwan		0.121	0.169	0.174
Turkey	10	0.073	0.102	0.105
Bonus for Made in Turkey				
Steam or gas turbine		0.009	0.013	0.013
Generator & power electronics		0.049	0.068	0.070
Steam injector or gas compressor		0.049	0.068	0.070
Uganda	20	0.054	0.075	0.077

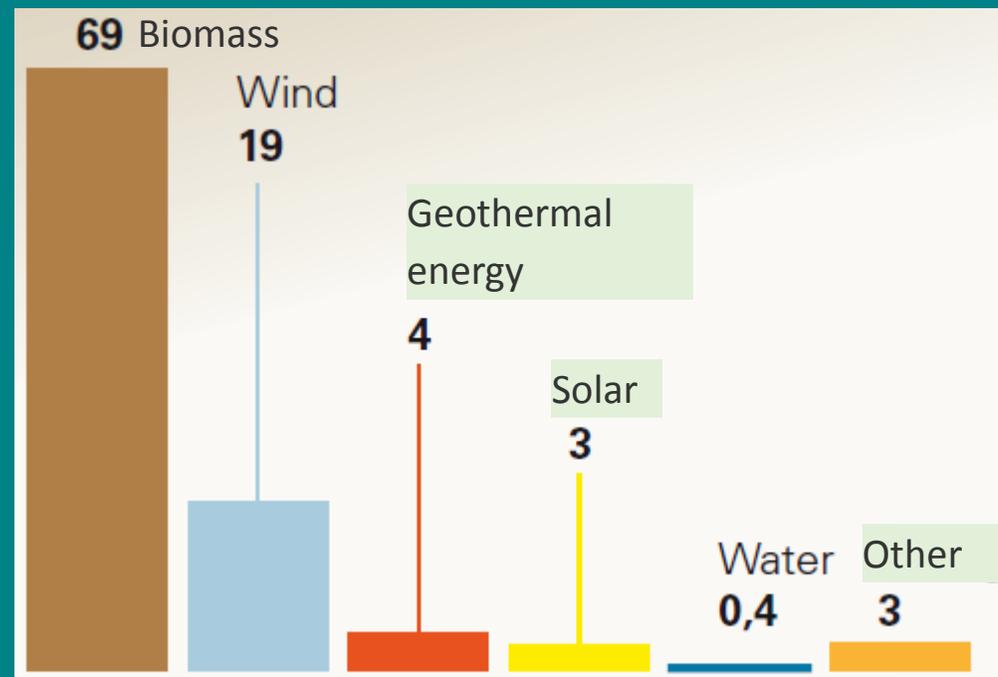
*Ceiling price rather than minimum price.

Renewable energy in the Netherlands

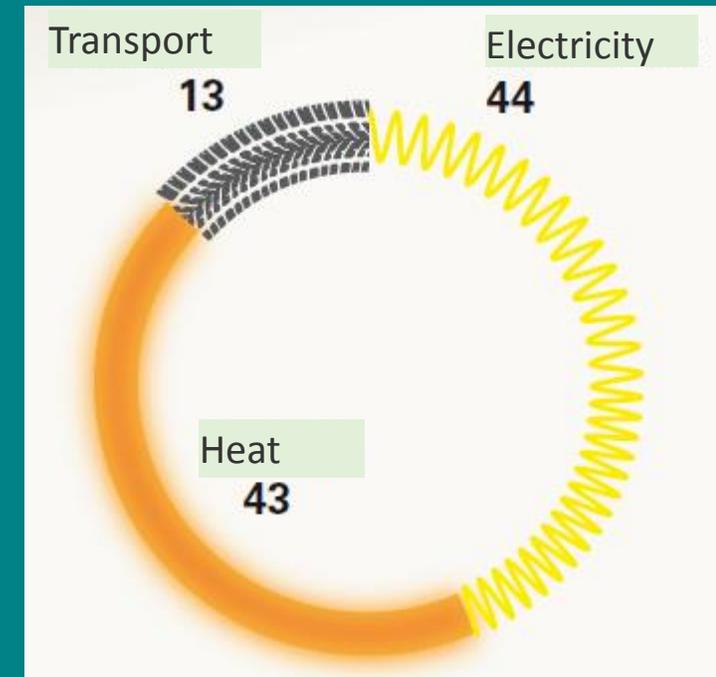
Goal: for renewable energy



Renewable energy mix 2013 in PJ



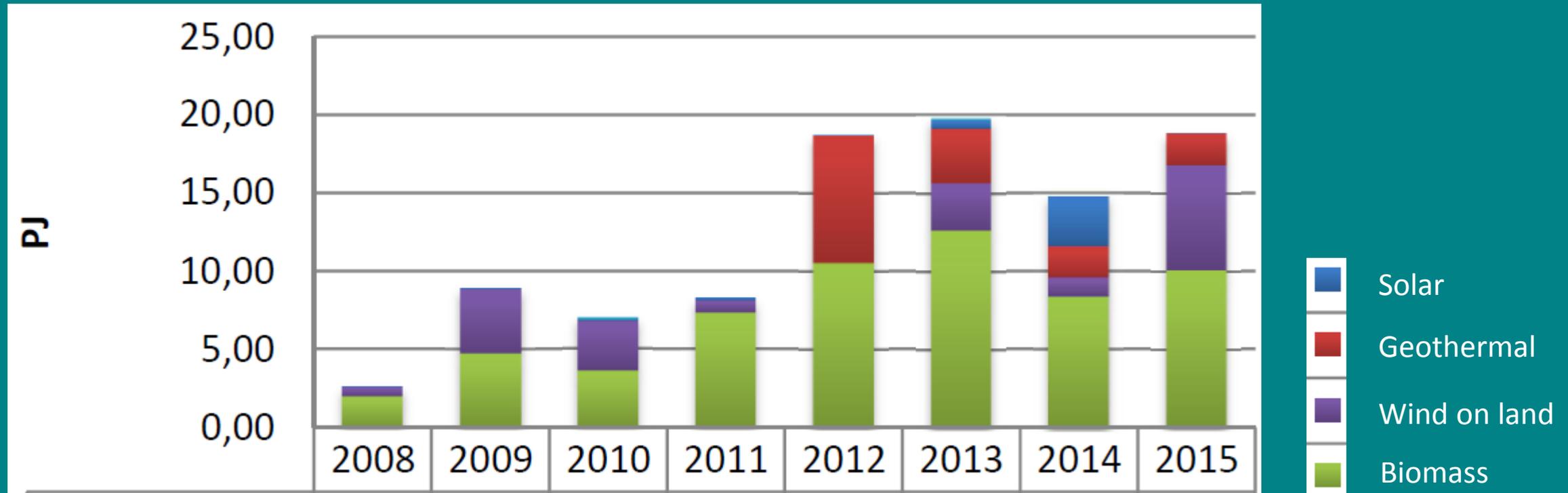
Renewable energy use in 2013 in percentage



Source: Algemene rekenkamer 2015
Stimulering van duurzame energieproductie

Renewable energy in the Netherlands

SDE+ subsidy awarded per year

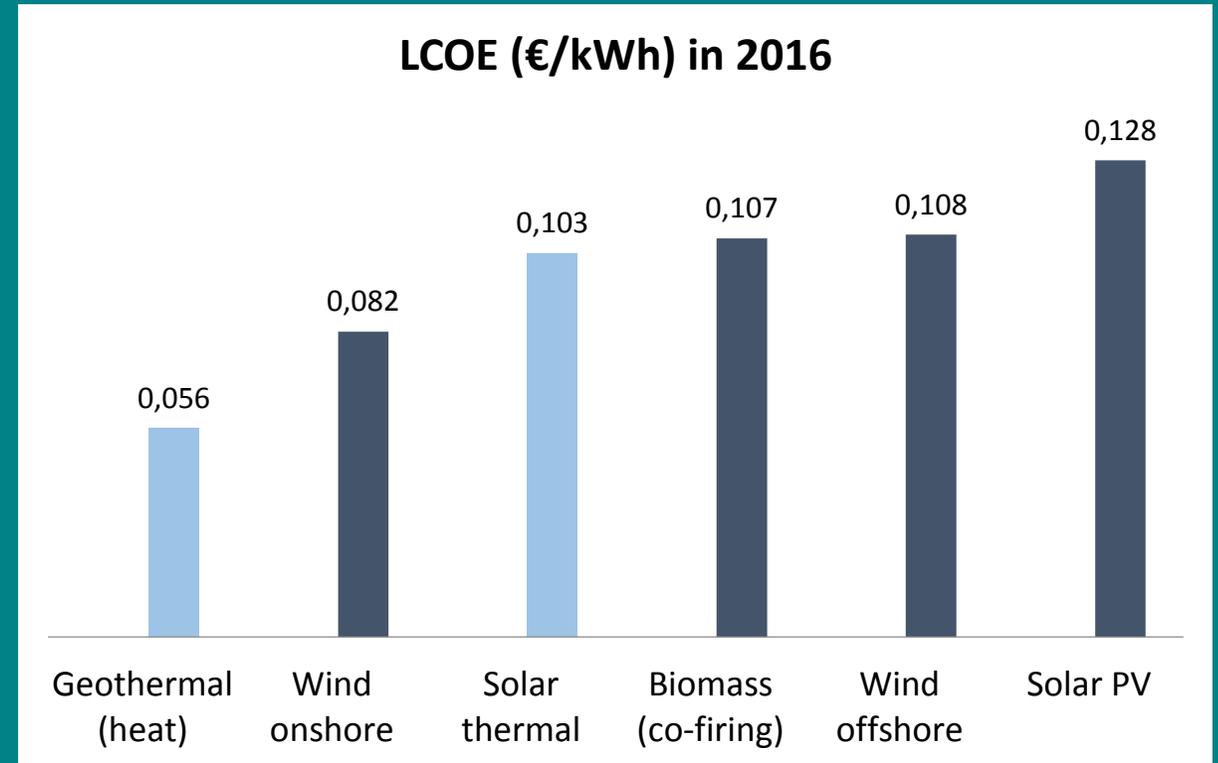


2012 is successful year for geothermal energy since there were both capital as FIT subsidies available

In 2015 four geothermal projects are honoured with in total 2 PJ of energy production (heat)

Renewable energy scheme the Netherlands

- Feed in tariffs (SDE+) are given for 15 years
- The subsidy (SDE+) is an annual fixed amount of money by the government
- The SDE+ is paid by a tax on energy use by consumers
- A cascading system is in place so that the cheapest renewable technology can claim the SDE+ money first
- Payments are done based on LCOE of technology minus the actual energy price and paid per produced kWh
- Reserves of SDE+ subsidy is based on the maximum a project can produce to prevent over spending the reserved budget by the government
- LCOE prices for each technology are updated annually



Light blue is heat and dark blue is electricity production

Goals of the renewable targets in 2020 will probably not be achieved in the Netherlands

Lessons learned:

- Successful renewable projects produce on average 26% less as the maximum predicted production
- Geothermal projects produce on average 45% less as predicted due to lower flow as predicted and long downtime periods during operation
- 16% of the awarded project is cancelled
- Time between grant and actual start of production is long. Only ~40% of the awarded projects did start with production after two years.